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# Survey paper : The derivation of the generalized functional equations describing self-similar processes

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## Abstract

The generalized functional equations describing a wide class of different self-similar processes are derived. These equations follow from the observation that microscopic function describing an initial self-similar process increases monotonically or even cannot have a certain value. The last case implies the behavior of trigonometric functions cos(zn), sin(zn) at > 1 and n >> 1 that can enter to the microscopic function and when the limits of the initial scaling region are increasing and becoming large. The idea to obtain the desired functional equations is based on the approximate decoupling procedure reducing the increasing microscopic function to the linear combination of the same microscopic functions but having smaller scales. Based on this idea the new solutions for the well-known Weierstrass- Mandelbrot function were obtained. The generalized functional equations derived in this paper will help to increase the limits of applicability in description of a wide class of self-similar processes that exist in nature. The procedure that is presented in this paper allows to understand deeper the relationship between the procedure of the averaging of the smoothed functions on discrete self-similar structures and continuous fractional integrals. © 2012 Diogenes Co., Sofia.

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## Keywords

Fractional calculus, Self-similar (fractal) processes, Solutions of functional equations, Weierstrass-Mandelbrot function